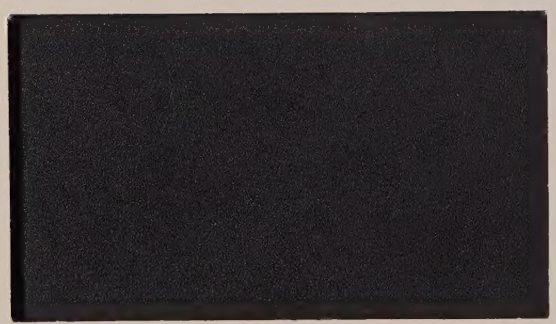
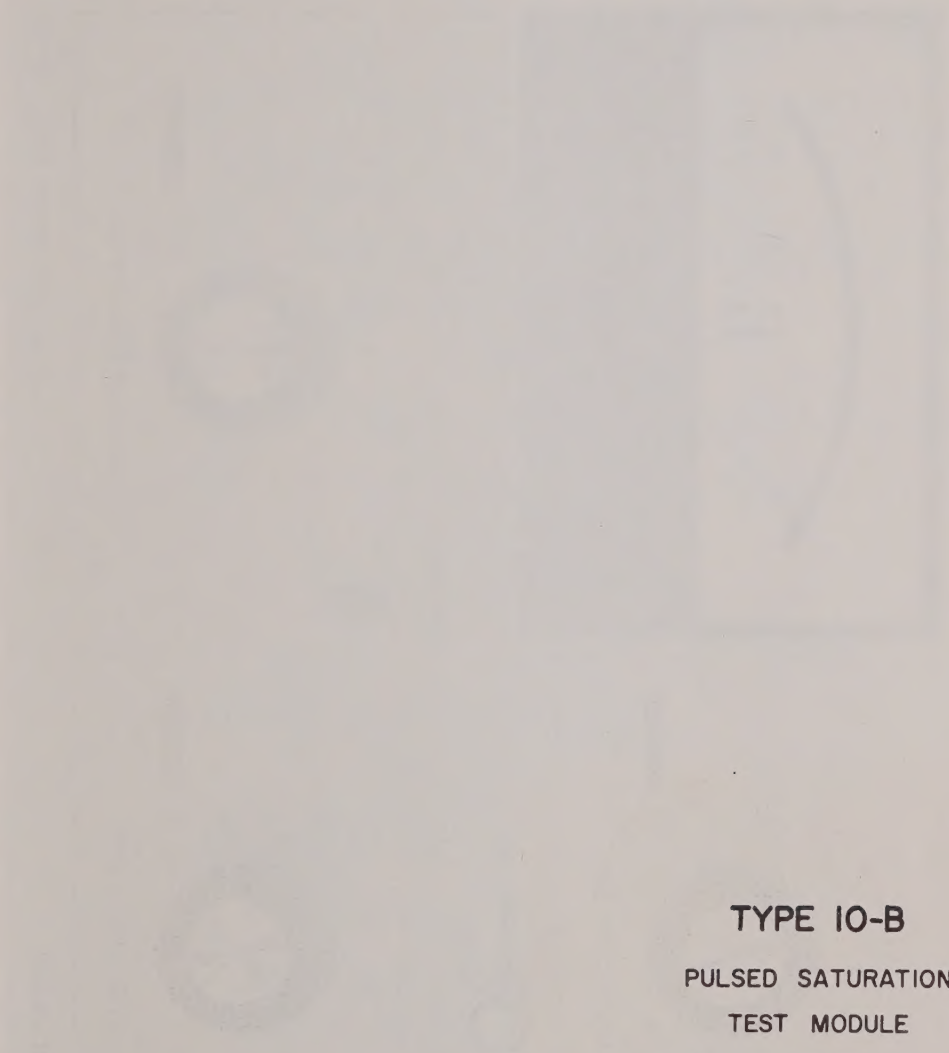
03M04A64

INSTRUCTION MANUAL

THE BIRTCHER CORPORATION INDUSTRIAL DIVISION
745 SOUTH MONTEREY PASS ROAD, MONTEREY PARK, CALIFORNIA

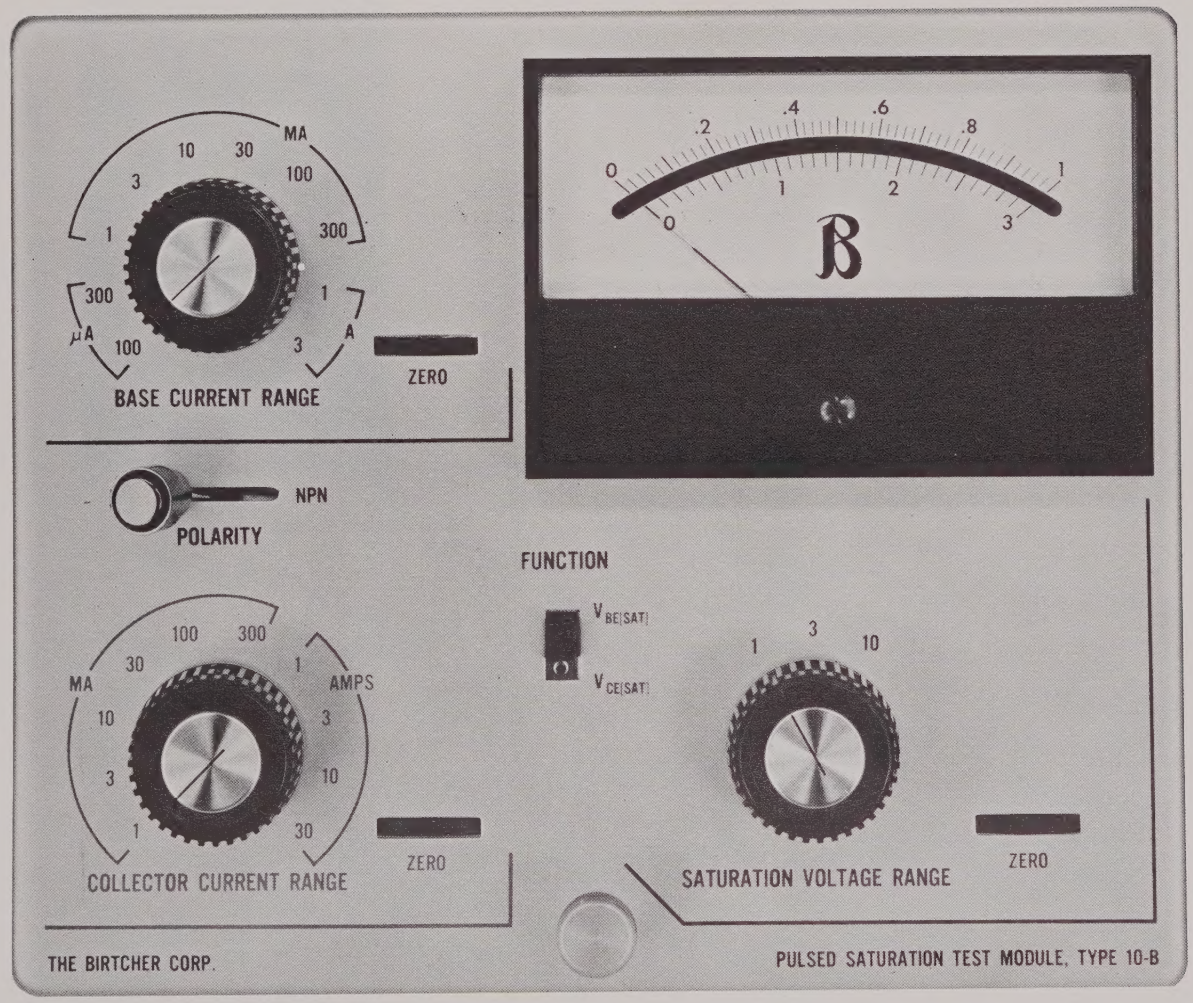




TYPE 10-B

PULSED SATURATION

TEST MODULE


MA
10
30
100
300
3
1
300
1
μA
100
3
A
BASE CURRENT RANGE
ZERO
.2
.4
.6
.8
0
1
2
3
0
NPN
POLARITY
FUNCTION
$V_{BE(SAT)}$
$V_{CE(SAT)}$
100
300
30
1
MA
AMPS
10
3
3
10
1
30
COLLECTOR CURRENT RANGE
ZERO
1
3
10
SATURATION VOLTAGE RANGE
ZERO
THE BIRTCHER CORP.
PULSED SATURATION TEST MODULE, TYPE 10-B

10B INSTRUCTION MANUAL

ADDENDUM #1
3/17/65

SN 10B 2000 UP

Page 11

Delete:	The sample gate diodes are reverse biased by a 9.8V battery B201, allowing up to 9.8V differential across sampling gate.	
Add:	The sample gate diodes are reverse biased by Zener Diode D218, and capacitor C224.	

Page 17

Delete:	C201 35,000 mfd @ 15 VDC Electrolytic	104-020
Add:	C201 10,500 mfd @ 15V Electrolytic	104-023

Page 18

Add:	D218 9.1V Zener	740-017

Page 19

Delete:	R228 1K	550-053

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SECTION 1

GENERAL DESCRIPTION

1.1. INTRODUCTION

The type 10B Transistor Saturation Voltage test module is used with the Birtcher Model 70 Semiconductor test set to provide reading of transistor $V_{CE(SAT)}$, $V_{BE(SAT)}$, and $R_{CE(SAT)}$ parameters.

Pulsed base current supply permits up to 30 amperes of collector current at low duty cycle to minimize heating.

TABLE 1-1. SPECIFICATIONS

A. Parameters measured:
$V_{CE(SAT)}$, $V_{BE(SAT)}$, $R_{CE(SAT)}$

B. Saturation voltage ranges:
1, 3, 10

C. Base current ranges:
100, 300 ua; 1, 3, 10, 30, 100, 300 ma; 1, 3 amp. @ 2% duty cycle (167 μsec @ 120 cps)

D. Collector current ranges;
1, 3, 10, 30, 100, 300 ma; 1, 3, 10, 30 amp.

E. Accuracy:
$\pm$ 3% of full scale on all measurements

F. Construction:
Aluminum alloy chassis. Anodized aluminum front panel with three-color, silk-screen markings.

G. Weight:
10 pounds

H. Dimensions:
8-1/2" wide x 7" high x 13" deep

SECTION 2

OPERATION

2.1. GENERAL

For ease and convenience of operation, the front panel of the Model 70 Semiconductor Test set, including the Type 10B Transistor saturation test module, has been divided into three functional sections. To aid the operator in learning and remembering the basic operation of the instrument, different colors are used for the markings in each section. Black markings refer to the base current controls and meter. Red markings refer to collector current controls and meters. Blue markings refer to saturation parameter function controls and meter. Function of controls and meters are listed on Table 2-1.

2.2. INITIAL TURN ON

1. Turn both ADJUST controls fully counter clockwise.
2. Set POLARITY switch to desired transistor type.
3. Put POWER switch in ON position. Allow 2-3 minutes for the set to warm up and stabilize.
4. Zero all meters with their respective zero controls.

NOTE: Check meter zero periodically while instrument is in use.

2.3. SATURATION VOLTAGE MEASUREMENT

1. Set FUNCTION switch to saturation parameter to be measured.
2. Set BASE CURRENT RANGE switch to desired I_B test range.
3. Set COLLECTOR CURRENT RANGE switch to desired I_C test range.
4. Depress TEST switch.
5. Turn upper ADJUST control until desired I_B is indicated.
6. Turn lower ADJUST control until desired I_C is indicated.
7. Set SATURATION VOLTAGE RANGE switch to lowest possible range without exceeding full scale reading on $V_{(SAT)}$ Meter. Read saturation voltage.

TABLE 2-1. FUNCTIONS OF CONTROLS AND METERS

CONTROL	DESCRIPTION AND FUNCTION
BASE CURRENT RANGE switch	Ten-position rotary switch providing selection of current supply and meter (Upper, Model 70) ranges. (Black markings)
I_B ZERO adj	Potentiometer used to zero I_B meter (Upper, Model 70) after warm-up. (Black markings)
ADJUST control (Upper, Model 70)	Uncalibrated control used to adjust base current of transistor under test. (Black markings)
METER (Upper, Model 70)	Dual-scale, mirror-backed meter; indicates base current of transistor under test. Ranges are selected by BASE CURRENT RANGE switch.
POLARITY switch	Two-position lever switch used to reverse power supply and meter polarity for testing of PNP or NPN transistors.
COLLECTOR CURRENT RANGE Switch	Ten-position rotary switch providing selection of current supply and meter (Upper, Model 70) ranges. (Red markings)
I_C ZERO adj	Potentiometer used to zero I_C meter(Lower, Model 70) after warm-up. (Red markings)
ADJUST CONTROL (Lower, Model 70)	Uncalibrated control used to adjust collector current of transistor under test. (Red markings)
METER (Lower, Model 70)	Dual-scale mirror-backed meter. Indicates collector current of transistor under test. Ranges are selected by COLLECTOR CURRENT RANGE switch.
METER (On test module)	Dual-scale, mirror-backed meter indicates saturation voltage of transistor under test. Range selected by SATURATION VOLTAGE RANGE switch.
SATURATION VOLTAGE RANGE	Three-position rotary switch providing selection of saturation voltage METER ranges. (Blue markings)
SAT. ZERO adj	Potentiometer used to zero $V_{(SAT)}$ Meter (module) after warm-up. (Blue markings)
FUNCTION switch	Two-position slide switch provides selection of saturation parameter measured.

2.4. SATURATION RESISTANCE MEASUREMENT

1. Set FUNCTION switch to $V_{CE(SAT)}$.
2. Repeat Steps 2 thru 7 of Saturation Voltage Measurement.
3. $R_{CE(SAT)} = \frac{V_{CE(SAT)}}{I_C}$

SECTION 3

THEORY OF OPERATION

With the Type 10B, the transistor is connected as shown in Figure 3-1:

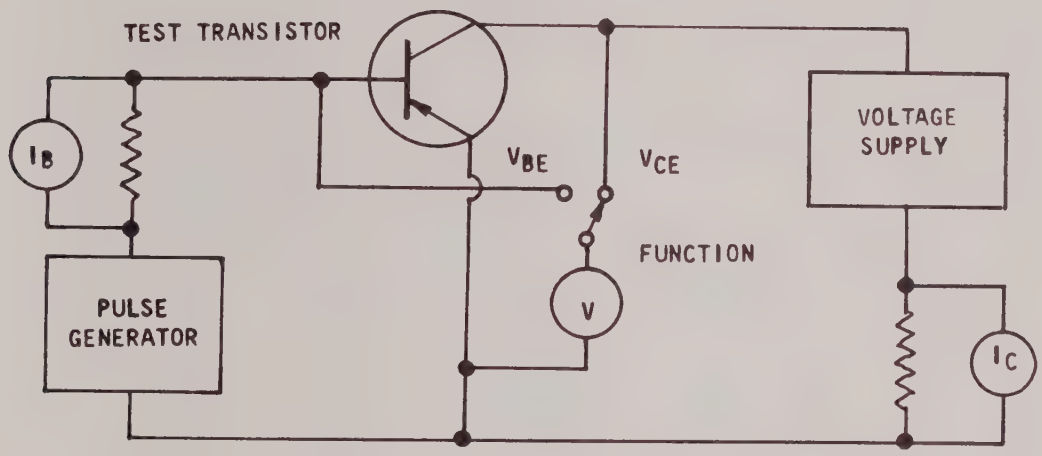
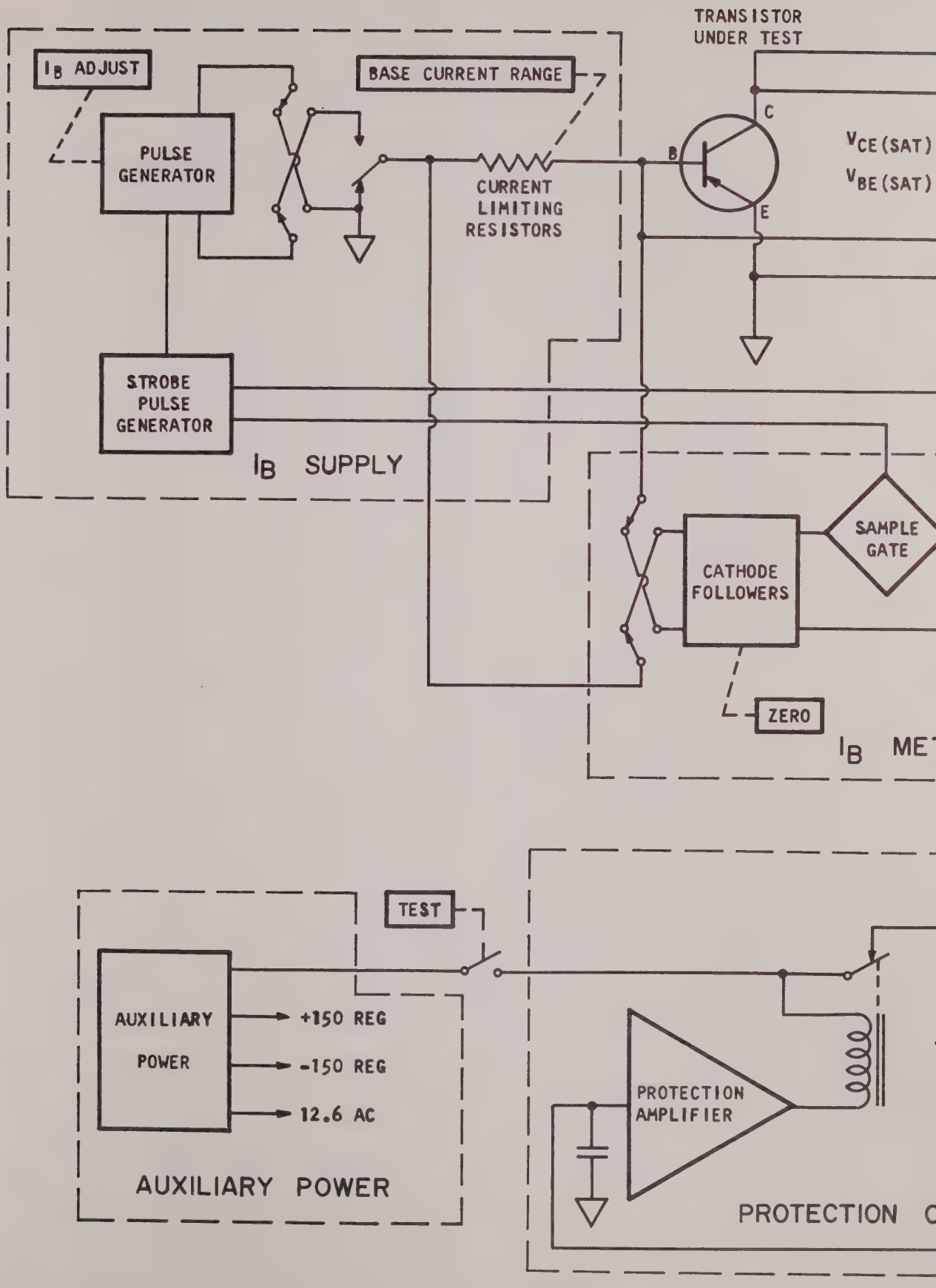


Figure 3-1. Simplified Circuit Diagram

The saturation parameters measured are defined as follows:

$V_{CE(SAT)}$	Voltage from collector emitter for given I_C and I_B while biased in collector saturation region.
$V_{BE(SAT)}$	Voltage from base to emitter while biased in a common emitter configuration. Usually I_C and I_B are specified.
$R_{CE(SAT)}$	Resistance from collector to emitter for given I_C and I_B. It is measured as: $\frac{V_{CE(SAT)}}{I_{C(specified)}}$


TRANSISTOR UNDER TEST
I_B ADJUST
BASE CURRENT RANGE
PULSE GENERATOR
CURRENT LIMITING RESISTORS
C
B
E
$V_{CE(SAT)}$
$V_{BE(SAT)}$
STROBE PULSE GENERATOR
I_B SUPPLY
SAMPLE GATE
CATHODE FOLLOWERS
ZERO
I_B ME
TEST
AUXILIARY POWER
+150 REG
-150 REG
12.6 AC
AUXILIARY POWER
PROTECTION AMPLIFIER
PROTECTION C

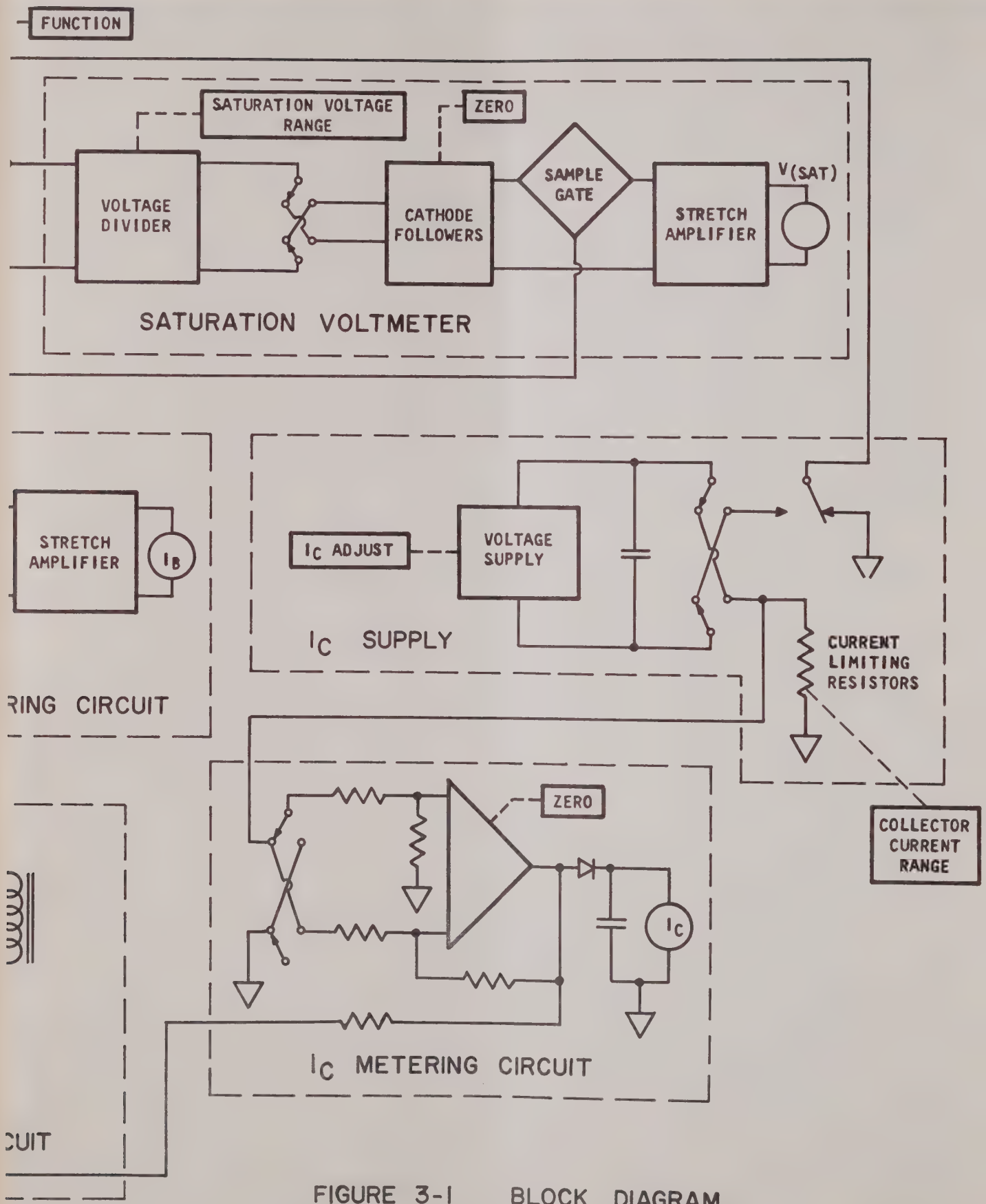


FIGURE 3-1 BLOCK DIAGRAM.
MODEL 70 SEMICONDUCTOR TEST SET AND 10 B TEST MODULE.

SECTION 4

CIRCUIT DESCRIPTION

4.1. BLOCK DIAGRAM

The electrical circuits of the 10B test module combined with the Model 70 are shown in the Block diagram Figure 4-1.

In order to minimize heating and reduce power supply requirements, the base current is pulsed at a low duty cycle. Collector current is supplied by an adjustable voltage supply with series current limiting resistors. Because of the different wave-forms present at the base and collector, a sampling type voltmeter is used to measure saturation voltages. I_B is also measured with this sampling technique. The collector current signal is amplified and peak detected. Because the collector current supply components are rated for low duty cycle operation, protection must be provided against shorting on leaky transistors.

NOTE: In the following circuit descriptions, refer to Figures 7-1 and 7-2 for component designation.

4.2. AUXILIARY POWER

Transformer T101 is used to convert 115V AC line voltage to voltages for plate and filament supplies.

Secondary winding 3 thru 5 is connected to D205A thru D to supply high voltage positive and negative full wave rectified output. C214A, B, and R269 form a capacitor input RC filter for the positive supply; output voltage is regulated by V201. The negative supply is filtered by C215 regulated by V202.

Amplifier filament voltage is supplied by secondary winding 9, 10, and 11.

4.3. BASE CURRENT GENERATOR

The base current generator provides variable amplitude 120 cps pulses to the base of the transistor under test, and delayed strobe pulses to sampling gates.

DC for the pulse generator circuitry is supplied by T102. Secondary winding (terminals 3, 4, and5) is full wave rectified by D103, D104 and filtered by C103. Secondary winding (terminals 6, 7, and 8) is full wave rectified by D202 and D203.

Syncronization to 120 cps is obtained by applying the full wave rectified 60 cycle sine wave to RC Network R246, R249, and C203. When the voltage

across C203 reaches approximately 10 volts unijunction transistor Q201 goes into negative resistance state and pulse output is generated across R251. R246 provides sync adjustment.

Pulses of adjustable duration and amplitude are generated by monostable multivibrator composed of Q202, Q203 and associated circuitry. Positive triggering pulses from the sync generator are applied to the base of Q202 thru C206. Pulse duration is determined by discharge time of C205; this is adjusted by variable resistor R252. Potentiometer R103 (I_B ADJUST) in series with the collector load resistor of Q202 supplies variable amplitude pulses to the input of cascaded emitter followers Q208 and Q207. Bias for the emitter follower stages is obtained from the full wave rectified supply by D204 and C208. Polarity of the pulse is switched by S203E, F (POLARITY) in series with the output of the pulse generator.

Relay K101 in series with the ungrounded pulse output allows pulse output to be removed from test jacks between tests or when overload condition exists.

Pulse current is limited by R202 thru R211 and R222. These are selected by S201 (BASE CURRENT RANGE).

Delay of strobe pulses is obtained by using the positive pulse output on the collector of Q203 to charge RC Network R256 and C209 in the emitter circuit of a second unijunction transistor Q209.

The strobe pulse width is obtained by multivibrator Q206, Q207 and associated circuitry. This circuitry is similar to the base current multivibrator.

Output to sampling gates is provided by transformer T103. The primary of T103 is driven by an emitter follower(Q205) which is AC coupled to the collector of Q206.

4.4. I_B METERING CIRCUIT

Base current is measured as the voltage developed across base current limiting resistors R203 thru R211; divider network R222 and R202 provide attenuation for input to amplifier stages. Polarity reversal to the input of the amplifier is made by S203 J, K.

The input stage of the amplifier section consists of twin triode V205 with both sections connected as cathode followers. R284 (ZERO) connected in the cathode of V205A is used to balance offset voltages developed in the sample gate and cathode follower stages.

Voltage on the arm of R284 is applied to the input of sample gate (D213 thru D216). The sample gate is self biased; Zener diode D212 allows up to 6 volt differential between input and output of gate circuits between strobe pulses. During the strobe pulse, C219 is charged to the value of voltage appearing between the cathodes of V205.

Pulse stretching is by cathode followers V206A and B with the voltage across C219 applied to the grids. Voltage between cathodes of V206 is applied to M101 (Upper, Model 70) for I_B indication. Calibration adjustment is by R291 in series with M101.

4.5. COLLECTOR CURRENT SUPPLY

The collector current supply provides variable current to the collector of the transistor under test.

Variable transformer T104 (I_C ADJUST) supplies 60 cycle AC to the primary of T103. AC voltage generated across secondary winding terminals 8 and 10 is full wave bridge rectified by diodes D201 A-D. Energy for pulsed collector current is stored in C201.

Polarity of the collector voltage is switch by S203 C, D (POLARITY) in series with the output of the collector supply.

Relay K101 in series with the collector lead allows collector bias to be removed from the test jacks between tests or when an overload condition exists.

Collector current limiting is provided by limiting resistors R212 thru R221 between the voltage supply and ground. These resistors are selected by S202 (COLLECTOR CURRENT RANGE).

4.6. I_C METERING CIRCUIT

The voltage developed across collector current limiting resistors R212 thru R221 is used for measuring collector current. Polarity reversing at the input of the amplifier is by S203 G, H.

The input signal is amplified by DC coupled amplifier and then peak detected. V207A and B form differential input stages, with cathode coupling. The plate of V207A is DC coupled to the grid of V208A by a neon glow lamp N201. A potentiometer R299 (ZERO) for adjusting plate voltage on V207B is used for balancing the amplifier. The plate of V208A is DC coupled by N202 to the grid of a cathode follower output stage V208B. Resistor R301 from the cathode provides a feedback to the input grid for gain stabilization.

The output signal is peak detected by D217 and C221. The voltage developed across C221 is measured by meter M101 (approx. 30 V full scale). Variable resistor R308 in series with M101 provides calibration adjustment.

4.7. PROTECTION CIRCUIT

The protection circuit consists of essentially two sections: the protection amplifier (including the sensing and control portions), and the power control relay, K201. Under normal conditions, overload relay K101 remains de-energized whenever the TEST-RESET switch S102 is operated to TEST. The contacts of K101 complete the circuit from the DC output voltage of rectifiers D101 and D102 to the coil of relay K201, energizing the relay. With K201 energized both base and collector supply circuits are completed, providing operating voltages to the transistor being tested.

Pulse output from the collector current amplifier is applied to R102. This resistor forms an intergrating network with C102. With 2% duty cycle and full scale indication on M101 the voltage developed across C102 is only 0.6 volts (2% x 30 volts). However, with continuous duty cycle as is the case with shorted or leaky transistors the voltage on C102 is equal to the peak output voltage of the amplifier. When the voltage between the emitter and base of unijunction Q102 exceeds approximately 4 volts (15% of full scale on I_C meter) it goes into a negative resistance state discharging C102 through the gate of the controlled rectifier Q101. This triggers Q101 into a conducting state, energizing K101 and causing overload indicator DS102 to come on. When K101 is energized, its contacts open and remove power from the coil of K201, opening the contacts of this relay and thus removing potentials from the transistor being tested.

When the overload condition is corrected, S102 must momentarily be opened (operated to RESET) then again closed (TEST) to restore normal operation.

4.8. SATURATION VOLTMETER

The saturation parameter measured is selected by switch S204 (FUNCTION). To eliminate measurement errors caused by I_R drop in emitter and collector leads, voltage sensing leads are used. These are connected to anode and cathode test terminals.

Polarity reversal to input of amplifier is made by S203A, B (POLARITY).

Because of waveforms measured, a sampling type voltmeter is used. The input and stretch amplifiers are identical to those used in the Base current amplifier. However, in order to measure V_{CE} saturation voltages with V_{CE} of 10 volts or more between current pulses, a different technique is used to bias the sampling gate. Zener diode D206 clamps the voltages between the cathodes of the input tubes to 6 volts maximum. The sample gate diodes are reverse biased by a 9.8V vattery B201, allowing up to 9.8V differential across sampling gate. Voltage between cathodes of pulse stretch amplifiers is applied to M201 for saturation voltage reading. Calibration adjustment is by R281 in series with M201.

SECTION 5

MAINTENANCE

5.1. INSTRUCTION MANUAL

A Birtcher Instruction Manual usually contains hand made changes to diagrams and parts lists and sometimes texts. These changes are generally appropriate only to the instrument the manual was prepared for. These hand-made corrections show changes to the instrument that have been made after the printing of the manual.

There is a serial number on the warranty page of this manual. This is the serial number of your instrument. Be sure the manual number matches the instrument number when you order parts.

NOTE: Always include the instrument type and serial number in any correspondence regarding the instrument.

5.2. REPLACEMENT PARTS

5.2.1. Standard Components

Birtcher will supply replacement components at current net prices. However, since most of the components are standard electronic and radio parts, you can probably obtain them locally faster than we can ship them to you from the factory in Monterey Park, California. Be sure to consult the parts list to see what tolerances are required.

5.2.2. Selected Components

We specially select some of the components whose values must fall within prescribed limits. By sorting through our regular stocks the components so selected will have standard retma color coding showing the value and tolerance of the stock they were selected from, but they will not in general be replaceable from dealer stock.

5.2.3. Birtcher Manufactured Parts

Birtcher manufactures almost all of the mechanical parts and some of the components used in the instrument. If you order a mechanical part be sure to describe the part completely to prevent any unnecessary delay in filling your order. When you have any questions about mechanical parts or Birtcher manufactured components, contact our nearest field sales representative or write to the service department at the factory in Monterey Park, California.

5.3. REMOVAL AND REPLACEMENT OF PARTS

The procedures required for replacement of most parts in the type 10B are obvious. Detailed instructions for their removal are not required. Other parts, however, can be best removed if a definite procedure is followed. Instruction for the removal of some of these parts are contained in the following paragraphs.

5.3.1. Replacement of Switches

Methods of removal of defective switches, are, for the most part, obvious and only a normal amount of care is required. Single wafers are normally not replaced on the switches used in the type 10B and if one wafer is defective, the entire switch should be replaced. Switches may be ordered from Birtcher either wired or unwired as desired.

5.3.2. Replacement of PC Board Components

Some components in the 10B are mounted on a printed circuit board. To avoid damage to the pc board when replacing components the following precautions should be observed:

Use a low power soldering iron (50 watts maximum).

Use only a high quality rosin core solder. NEVER A PASTE FLUX. After soldering, clean off any excess flux.

When replacing components with multiple mounting pins such as tube sockets, transistors, potentiometers, etc., it will be necessary to lift each pin slightly, working around the components several times until it is free.

5.4. CALIBRATION

The type 10B test module is a stable instrument and should not require frequent calibration. However, it will be necessary to calibrate certain parts of the instrument when tubes or components are changed. Also, a periodic calibration is desireable from the standpoint of preventative maintenance.

In the instructions that follow, the steps are arranged in the proper sequence for full calibration. Each numbered step contains the information necessary to make one adjustment. If a complete calibration is not necessary, you may perform individual steps.

The following equipment is necessary for a complete calibration of the 10B test module:

1. DC Voltmeter having a sensitivity of at least 5000 ohms/v and an accuracy of at least 1% @ 10 volts.

2. Differential input DC coupled oscilloscope having sensitivity of at least 1 volt/cm, with calibrated input attenuator - Calibrated sweep rates of 100 msec, 1 msec and 10 msec/cm. (Tektronix 503 or equivalent)

3. Birtcher type B5538 power transistor test adapter.

4. Birtcher type B5536 module connector cable. (Not necessary, but helpful)

5. 1 and 0.1 ohm 1/2% 1/2 watt resistors.

5.4.1. Preliminary

Connect 10B test module to Model 70 Basic unit with module connector cable (if none available, remove Model 70 from cabinet and install 10B in Model 70). Install power transistor test adapter. Mechanically zero all meters. Place front panel controls in the following positions:

TEST	RESET
ADJUST controls	CCW
POLARITY	PNP
FUNCTION	$V_{CE(SAT)}$
SATURATION VOLTAGE	10V
BASE CURRENT	100 ma
COLLECTOR CURRENT	1 amp

Connect the Model 70 to power source and turn POWER switch ON. Allow 10-15 minutes warm-up. Adjust all meters for zero indication using zero controls.

5.4.2. Base Current Meter

1. Connect 1 ohm 1/2% resistor between emitter and base leads.

2. Connect scope ground to emitter lead and one scope input to base lead. Ground second scope input.

3. Depress TEST switch and increase upper ADJUST control for .1V pulse on scope; I_B meter should indicate 100 ma $\pm$ 3%. If error exists, adjust R291 for correct indication on I_B meter.

5.4.3. Collector Current Meter see other book

1. Connect PNP power transistor with .1 ohm 1/2% resistor in series with collector lead.

2. Connect scope ground to emitter lead. Connect scope inputs to read voltage across the .1 ohm resistor in series with collector.

3. Set BASE CURRENT switch to 100 ma position.

4. Set COLLECTOR CURRENT switch to 1 amp position.

5. Depress TEST switch and increase upper ADJUST control for 100 ma I_B. Increase lower ADJUST control for .1V pulse on scope; I_C meter should indicate 1 amp $\pm$ 3%. If error exists, adjust R308 for correct indication on I_C meter.

5.4.4. Saturation Voltage Meter

1. Connect precision DC voltmeter to emitter (positive) and collector (negative) leads of power transistor test adapter.

2. Set upper ADJUST control ccw.

3. Depress TEST switch and adjust lower ADJUST control for 10 volt reading on DC voltmeter; the saturation voltmeter should indicate 10 volts $\pm$ 3%. If error exists, adjust R281 for correct indication on saturation voltmeter.

5.5. FACTORY ADJUSTMENTS

The only adjustments to be made on the 10B that are not covered in the calibration instructions involve syncronizing and timing the pulse generator.

Equipment required for these adjustments are a DC Scope and module connector cable (Items 2 and 4, described in calibration procedure).

5.5.1. Preliminary

Connect 10B Test Module to Model 70 Basic Unit with module connector cable. Connect Model 70 to line voltage with isolating plug. Place front panel controls in the following positions:

ADJUST controls	CCW
TEST	RESET
POWER switch	ON
R246 SYNC	CCW

5.5.2. Sync

1. Connect scope ground to Terminal 5 on pulse generator pc board.

2. Connect scope input to Terminal 4 on pulse generator pc board. Vert. sensitivity 5V/cm. Sweep 5 milliseconds/cm. Trigger on line.

3. Turn R246 clockwise until pulses syncronize with line at 120 cps Rotate R246 clockwise 1/2 turn further.

5.5.3. Pulse Width

Leave scope connected as in sync adjustment procedure.

1. Set scope sweep to .1 millisecond/cm. Set trigger to internal and adjust so leading of pulse triggers scope.

2. Adjust R252 for 200 msec pulse width.

SECTION 6

PARTS LIST

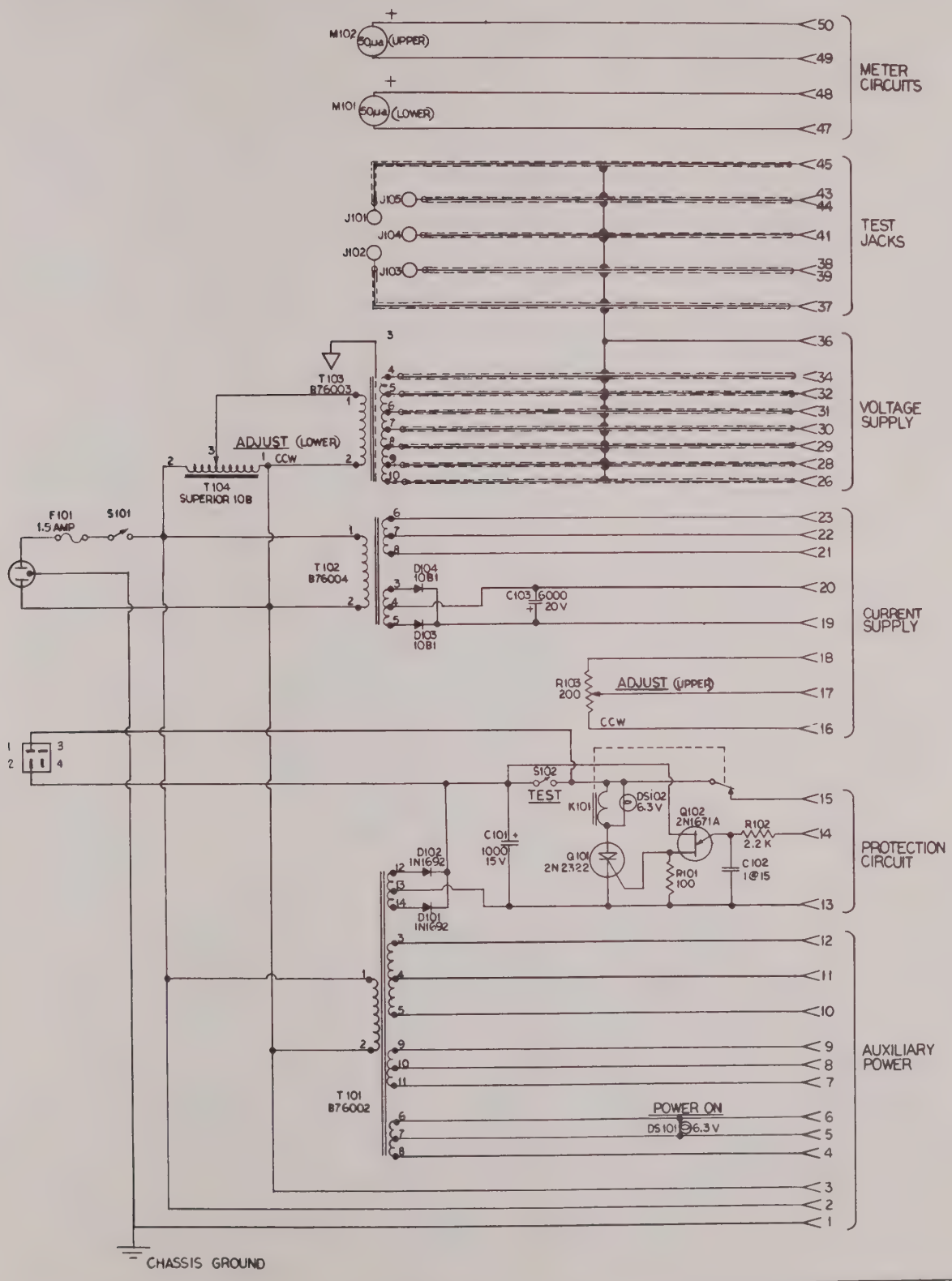
Batteries	Description	Part Number
B201	Mercury 9.8 Volt	020-000
Capacitors		
C201	35,000 MFD @ 15 VDC Electrolytic	104-020
C202	.01 MFD @ 600 VDC Disc	100-075
C203	.01 MFD @ 600 VDC Disc	100-075
C204	500 MFD @ 25 VDC Electrolytic	104-007
C205	.1 MFD @ 500 VDC Disc	100-076
C206	.01 MFD @ 600 VDC Disc	100-075
C207	.005 MFD @ 1000 VDC Disc	100-077
C208	500 MFD @ 25 VDC Electrolytic	104-007
C209	.01 MFD @ 600 VDC Disc	100-075
C210	.01 MFD @ 600 VDC Disc	100-075
C211	.05 MFD @ 600 VDC Disc	100-078
C212	1 MFD @ 15 VDC Electrolytic	104-015
C213	.005 MFD @ 1000 VDC Disc	100-077
C214	10-20-30 MFD @ 350 VDC Electrolytic Triple	104-200
C215	80 MFD @ 300 VDC Electrolytic	104-018
C216	.1 MFD @ 500 VDC Disc	100-076
C217	.1 MFD @ 500 VDC Disc	100-076
C218	.1 MFD @ 500 VDC Disc	100-076
C219	.1 MFD @ 500 VDC Disc	100-076
C220	200 MMFD @ 1000 VDC Disc	100-025
C221	1 MFD @ 50 VDC Electrolytic	104-019
C222	5 MMFD @ 1000 VDC Disc	100-000
C223	100 MMFD @ 1000 VDC Disc	100-026
Diodes		
D201	SCBR 3	740-015
D202	SC 1	740-006
D203	SC 1	740-006
D204	SC 1	740-006
D205	SCBR 6	740-009
D206	6 Volt Zener Diode	740-014
D207	SC 1	740-006
D208	1N457	740-013
D209	1N457	740-013
D210	1N457	740-013

Diodes (cont.)	Description	Part Number
D211	1N457	740-013
D212	6 Volt Zener Diode	740-014
D213	1N457	740-013
D214	1N457	740-013
D215	1N457	740-013
D216	1N457	740-013
D217	1N457	740-013
Relay		
K201	3 PDT 6 VDC	540-005
Meter		
M201	50 ma full-scale $\pm$ 1% 2.5 K $\pm$ 20% int. Res.	A76001
Lamps		
N201	55 ST 2S Neon	340-001
N202	55 ST 2S Neon	340-001
Transistors		
Q201	2N1671A Unijunction	741-000
Q202	2N1308 NPN	741-003
Q203	2N1175 PNP	741-002
Q204	2N1671A Unijunction	741-000
Q205	2N1175 PNP	741-002
Q206	2N1308 NPN	741-003
Q207	2N1175 PNP	741-002
Q208	2N1175 PNP	741-002
Q209	2N1544 Power PNP	741-001
Resistors		
R201	35 ohm 5 Watt 10% wirewound	553-050
R202	10 K, 1%, Dep. Carb.	551-026
R203	50K, 1%, Dep. Carb.	551-051
R204	11.1 K, 1%, Dep. Carb.	551-050
R205	3.45 K, 1% Dep. Carb.	551-027
R206	1.01 K, 1% Dep. Carb.	551-030
R207	333 ohm, 1%, Dep. Carb.	551-002
R208	100 ohm, 1% Dep. Carb.	551-003
R209	33.3 ohm, 1% Wirewound	553-054
R210	10 ohm, 1% Wirewound	553-025
R211	3.33 ohm, 1% Wirewound	553-008
R212	10 K, 1% Dep. Carb.	551-026
R213	3.3K, 1% Dep. Carb.	551-031

Resistors(cont.)	Description	Part Number
R214	1 K, 1% Dep. Carb.	551-001
R215	333 ohm, 1% Dep. Carb.	551-002
R216	100 ohm, 1% Dep. Carb.	551-003
R217	33.3 ohm, 1% Wirewound	553-054
R218	10.0 ohm, 1% Wirewound	553-025
R219	3.33 ohm, 1% Wirewound	553-008
R220	1.0 ohm, 2 Watt, 1% Wirewound	553-017
R221	.333 ohm, 5 Watt, 1% Wirewound	553-018
R222	90 K, 1% Dep. Carb.	551-055
R223	700 K, 1% Dep. Carb.	551-088
R224	200 K, 1% Dep. Carb.	551-087
R225	100 k, 1% Dep. Carb.	551-057
R226	10 K	550-101
R227	10 K	550-101
R228	1 K	550-053
R229	3 M, 1% Dep. Carb.	551-090
R244	1 K	550-053
R245	1 K	550-053
R246	500 K, Trimpot, Variable	554-082
R247	100 ohm	550-026
R248	47 ohm	550-000
R 249	470 K	550-152
R250	220 ohm	550-050
R251	100 ohm	550-026
R252	1 K, Trimpot, Variable	554-000
R253	4.7 K	550-078
R254	220 ohm	550-050
R255	220 ohm	550-050
R256	4.7 K	550-078
R257	100 ohm	550-026
R258	1 K	550-053
R259	220 ohm	550-050
R260	220 ohm	550-050
R261	220 ohm	550-050
R262	820 ohm	550-058
R263	4.7 K	550-078
R264	220 ohm	550-050
R265	220 ohm	550-050
R266	1 K	550-053
R267	2.7 K	550-076
R269	1.5 K, 2 Watt	550-085
R270	1 K, 2 Watt	550-055

Resistors(cont.)	Description	Part Number
R271	3.3K, 2 Watt	550-086
R272	100 K	550-127
R273	100 K	550-127
R274	2 K, Variable	554-027
R275	47 K	550-126
R276	47 K	550-126
R277	1 K	550-053
R278	1 K	550-053
R279	470 ohm	550-052
R280	470 ohm	550-052
R281	10 K, Variable	554-026
R282	100 K	550-127
R283	100 K	550-127
R284	2 K, Variable	554-027
R285	47 K	550-126
R286	47K	550-126
R287	1 K	550-053
R288	1 K	550-053
R289	470 ohm	550-052
R290	470 ohm	550-052
R291	10 K, Variable	554-026
R292	100 K	550-127
R293	100K	550-127
R294	1 M, 1% Dep. Carb.	551-079
R295	1 M, 1% Dep. Carb.	551-079
R296	180 K	550-155
R297	150 K	550-156
R298	27K	550-128
R299	25 K, Variable	554-051
R300	27 K	550-128
R301	3 M, 1% Dep. Carb.	551-090
R302	1.5 M	550-179
R303	1.5M	550-179
R304	33 K	550-125
R305	100 K	550-127
R306	1 K	550-053
R307	15 M	550-186
R308	1 M, Variable	554-075
R309	100 K	550-127

Switches	Description	Part Number
S201	Rotary 2 Pole, 10-position (S)	A76172
S202	Rotary 3 Pole, 10-Position(S)	A76174
S203	Lever 2 Pole, 2-Position(NS)	A76125
S204	Slide Switch DPDT	874-001
S205	Rotary 1 Pole, 3-Position(NS)	A76173
Transformers		
T201	Pulse Transformer	B76117
Tubes		
V201	OA2	910-000
V202	OA2	910-000
V203	12AT7A	910-155
V204	12AX7A	910-150
V205	12AT7A	910-155
V206	12AX7A	910-150
V207	12AT7A	910-155
V208	12AT7A	910-155



4 RESISTANCES IN OHMS.
3. UNDERLINED CONTROL DESIGNATIONS APPEAR ON FRONT PANEL
2 CAPACITANCES IN μfd.
1. RESISTORS ½W, ±10%, CARBON.

NOTES: UNLESS OTHERWISE SPECIFIED.

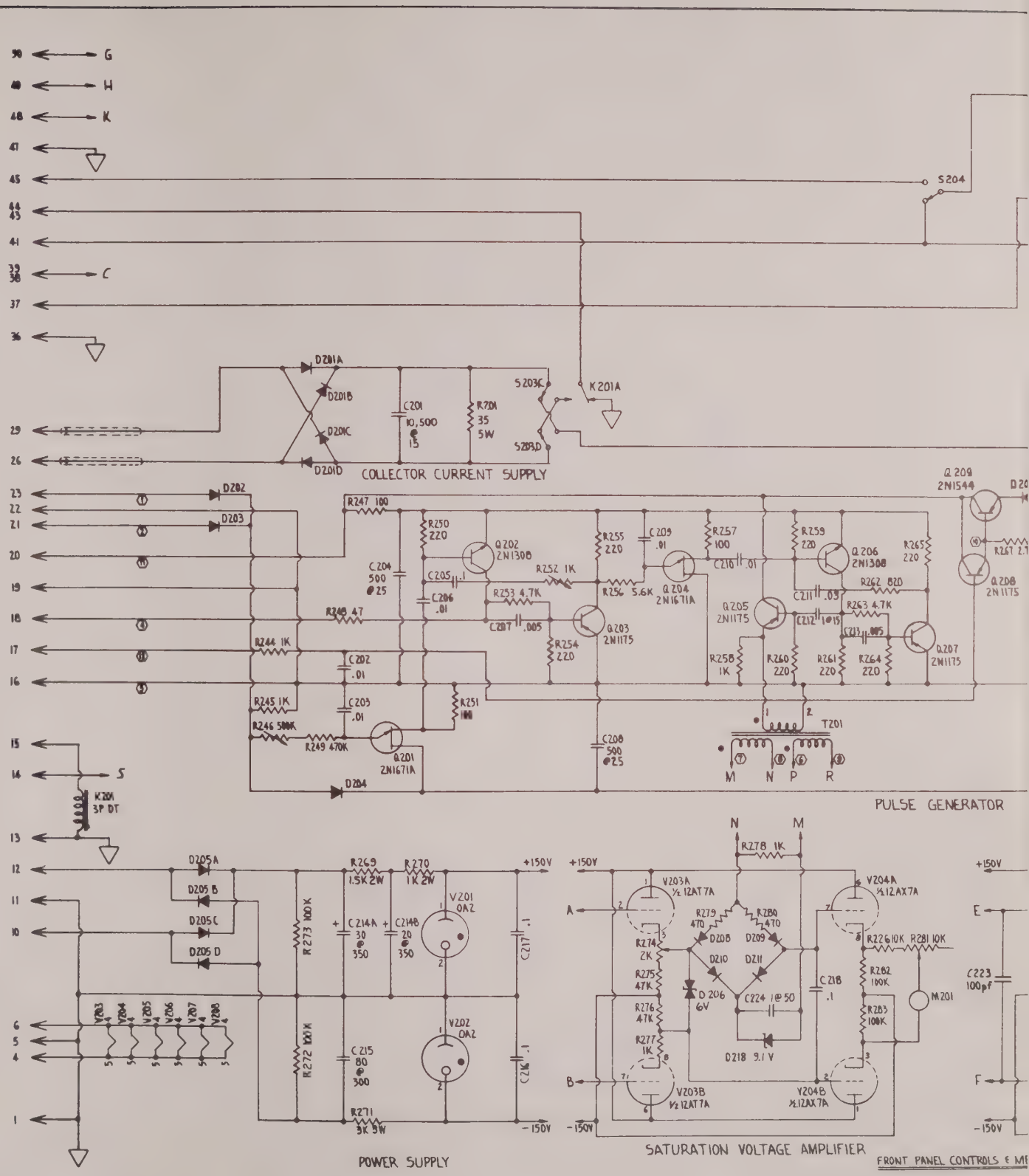
REV.	DESCRIPTION	DATE	DRWN	APPD.
D	GROUNDED TERMINAL 3 ON T 103	3-1-63	E.B.	RM
C	REMOVED R 104, R 105 & D 105. REV. PROTECT. CIRC., R101 WAS 220Ω R 102 WAS 100Ω, C 102 WAS 5, Q 101 WAS T1 145A0	4-29-63	E.B.	RM
B	ADDED D10 5 IN118	3-18-63	L.M.	RM
A	Q 102 WAS 2N 1761, R 102 WAS 100K, C102 WAS .25, NOTE 4 ADDED. F 101 WAS 1 AMP.	2/22/63	A.V.K.	RM

REVISIONS

BIRTCHER CORP./INDUSTRIAL DIVISION

MODEL 70
SEMICONDUCTOR TEST SET
BASIC UNIT
SCHEMATIC

DRWN: A.V.K. DATE: 6.25.62. | APPD: RM DATE: 6.26.62 | REV. D

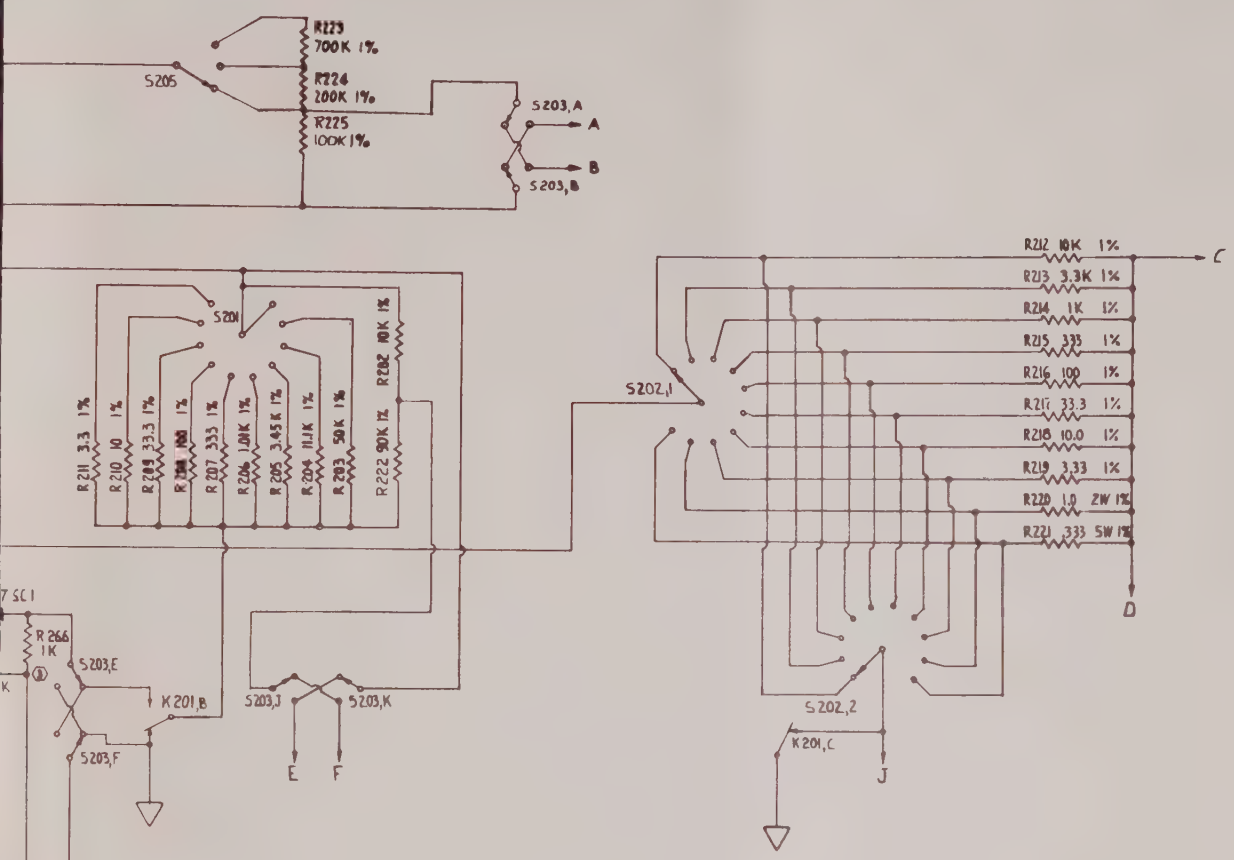


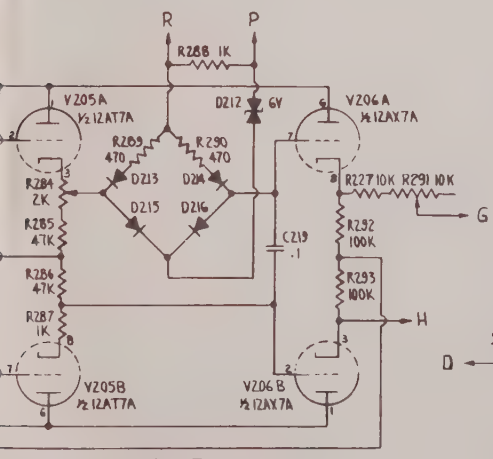
FRONT PANEL CONTROLS & MI

S201	BASE CURRENT
S202	COLLECTOR CU
S203	POLARITY
S204	FUNCTION
S205	SATURATION VO
R284	ZERO (BASE CU
R299	ZERO (COLLECT
R274	ZERO (METER
M201	SATURATION

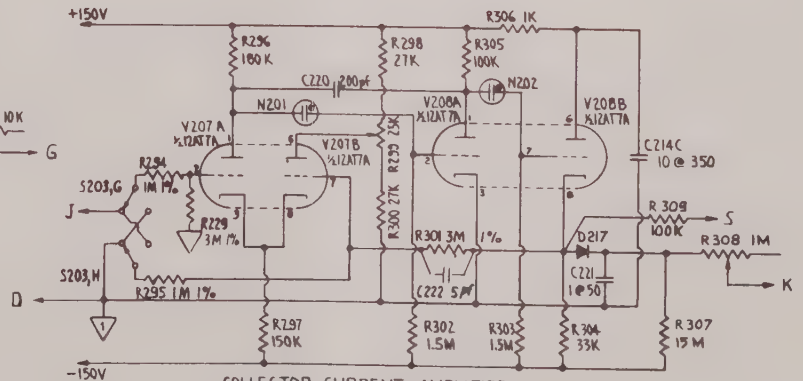
5. P.C. BOARD TERMINALS ARE SHOWN ○
4. SHIELDS GROUNDED.
3. ROTARY SWITCHES SHOWN IN MOST CCW POSITION.
2. CAPACITANCES IN μfd @ 500 V.
1. RESISTORS ½W, ±10%, CARBON.

NOTES: UNLESS OTHERWISE SPECIFIED





BASE CURRENT AMPLIFIER



COLLECTOR CURRENT AMPLIFIER

TERS

RANGE
RENT RANGE

TAGE RANGE
RENT)
R CURRENT)

LTAGE

REV.	DESCRIPTION	DATE	CKD	APPD.
G	C201 WAS 33,000	2-26-65	LB	[illegible]
F	DELETED R201, R218; ADDED C224, D218	1-25-65	LB	[illegible]
E	C211 WAS .05 AND R 271 WAS 3.3 K 2W	3-8-64	LB	KM

THE BIRTCHER CORP. ——— INDUSTRIAL DIVISION

SCHEMATIC
PULSED SATURATION TEST MODULE
TYPE 10-B

DRAWN	E B.	APPD	[illegible]	REV.
DATE	7-24-63	DATE	7-30-63	G

DISTRIBUTION B

WARRANTY

All our products are warranted against defects in materials and workmanship for one year from the date of shipment. Our obligation is limited to repairing or replacing parts which prove to be defective during the warranty period. We are not liable for consequential damage.

For assistance of any kind, including help with instruments under warranty, contact you authorized Birtcher sales representative for instructions. Give full details of the difficulty and include the instrument model and serial number. Service data or shipping instructions will be promptly sent to you. There will be no charge for repair of instruments under warranty, except transportation charges. Estimates of charges for non-warranty or other service work will always be supplied if requested before works begins.

Serial Number_____